Linalool and methyl chavicol present basil (*Ocimum sp.*) cultivated in Brazil

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RESUMO: **Linalol e metil-chavicol presentes em manjericão (*Ocimum sp.*) cultivados no Brasil**. No Brasil, as espécies de *Ocimum* são conhecidas como ervas aromáticas e restaurativas. Nesse trabalho foi estudado a composição química dos óleos essenciais das folhas frescas e secas de manjericão (*Ocimum sp)* obtido por hidrodestilação e analisados por CG-FID e CG-EM. Os teores encontrados foram de 0,70% para as folhas secas e 0,26% para as folhas frescas. Os componentes majoritários foram: Linalol (29,50-32,26%) e metil-chavicol (36,81-41,62%). Eucaliptol também foi detectado (9,99-7,68%). O óleo das folhas secas apresentou composição química mais complexa. Esse trabalho contribui para o conhecimento das plantas medicinais de ocorrência no Brasil.

Palavras-chave: folhas secas, folhas frescas, Lamiaceae, análise CG

ABSTRACT: In Brazil, *Ocimum* species are commonly known as aromatic and restorative herbs. The present research aimed to study the chemical composition of the essential oils of fresh and dry basil (*Ocimum sp)* leaves obtained by hydrodistillation and analyzed by GC-FID and GC-MS. The obtained yield was 0.70% for dry leaves and 0.26% for fresh leaves. The major compounds were: linalool (29.50-32.26%) and methyl chavicol (36.81-41.62%). Eucalyptol could also be detected (9.99-7.68%). The oil from dry leaves presented a more complex chemical composition. This study serves to contribute to the knowledge of medicinal plants occurring in Brazil.

Key words: dry leaves, fresh leaves, Lamiaceae, CG analysis

INTRODUCTION

The *Ocimum* genus (Lamiaceae family) includes approximately 60 species, normally found in tropical and subtropical regions (Paton, 1992). *Ocimum* species have encouraged great economic interest due to their medicinal properties and aromatic chemical characteristics (Amaral et al.,1999; Werker et al.,1993), which allow their use in perfume and cosmetic industries. They are also commonly used as condiments in sausage and frozen food industries, as well as in their natural form (Martins et al., 1994). In Brazil, there are a number of *Ocimum* species (Gupta, 1994), which are commonly found as aromatic and restorative herbs that alleviate spasms, lower fevers, and improve digestion, in addition to being effective against bacterial infections and in the fight against intestinal parasites (Lorenzi & Matos, 2002). In the state of Bahia, basil (*Ocimum sp.*) has been used in the treatment of fever and flu symptoms (Moreira et al., 2002). The aim of the present study is to investigate the composition of the essential oil of fresh and dry leaves of *Ocimum sp.*, a medicinal plant commonly used by the Brazilian people and widely marketed throughout Brazil.

MATERIAL AND METHODS

Plant material

Aerial parts of *Ocimum sp* at flowering stage were collected, at random, in August 2009 in Vila Cachoeira, located on Ilhéus-Itabuna highway, Km 13, longitude 39º08'96"W and latitude 14º48'55"S, in Ilhéus, Bahia, Brazil. The voucher specimen was deposited in the Herbarium of Univ Estadual de Santa Cruz (HUESC) under the number HUESC 10.126. The fresh leaves were dried by forced ventilation at 50ºC (De Leo & Cia LTDA) for 3 hours until a constant weight was reached.

Essential oil

The plant material underwent hydrodistillation using a Clevenger apparatus for 2 hours. The oil was separated by using dichloromethane, dried with

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anhydrous sodium sulfate and concentrated. The essential oil content was determined in triplicate (mL of oil per 100g of plant material).

Chromatography analysis

The essential oils were analyzed by means of a Saturn Varian 3800 gas chromatograph (FID-detector). This chromotograph was equipped with a VF-5ms capillary column (30m x 0.25mm x 0.25μm film thickness), using helium as a carrier gas, together with a flow rate of 1.0 mL min^{-1}, and an injection temperature of 250°C. The column programming began at 100º C per min., followed by a continuous increase of 10ºC until the temperature reached 300ºC, which was maintained for 5 min. The sample was dissolved in MeOH to provide a 10% w/v solution; 1μL of sample solution was injected in the split 1:10. GC-MS qualitative analyses were performed by using a Varian Chromopack 2000 MS/MS equipped with the same VF-5ms capillary column and the same column programming. The operation mode was an electron impact of 70eV, scan rate, 1 scan/s, mass range 40-650 Da. The trap and the transferline temperature were 200°C and 250°C, respectively. The compounds were identified from their linear indices on VF-5ms column, determined based on a homologous series of C_8-C_{26} *n*-alkanes (Doolh & Kratz, 1963), and by comparing their mass spectral fragmentation patterns with those stored in the data bank (NIST02) and in the literature (Adams, 2007).

RESULTS AND DISCUSSION

The dry leaves offer greater oil yield, 0.70%, compared to that from fresh leaves, 0.26%. In the essential oil from dry leaves, 13 compounds could be identified (Table 1), including 45.49% oxygenated monoterpenes, 0.45% monoterpenes, 9.74% sesquiterpenes, and 37.91% phenylpropanoides. Linalool (29.60%) and methyl chavicol (36.81%) proved to be the major compounds. In the essential oil from the fresh leaves, seven compounds could be identified, including 44.75% monoterpenes, 7.12% sesquiterpenes, and 41.62% phenylpropanoids. Eucalyptol was detected at the largest amount in the oils of dry leaves. The oil from dry leaves presented a greater complexity. Methyl eugenol, E-caryophyllene, bicyclogermacrene, β-guaiene, and tau-cadinol could only be observed in the oil from dry leaves. Linalool (32.26%) and methyl chavicol (41.62%) proved to be the major compounds, similarly to the essential oil from the dry leaves.

The difference in the chemical composition of these oils may be attributed to the process of drying the plant material. The drying process is of utmost importance for these aromatic species (Radunz et al., 2002; Corrêa et al., 2004; Costa et al., 2005), since it sets the metabolism of the plant, immobilizing the harmful enzymatic action of the existing active principles (David et al., 2006). The temperature used in the drying process of this species led to a loss of major compounds, Table 1. The heat used in the drying process was from an

TABLE 1. Composition of the essential oils of *Ocimum sp*

Compounds	RI[1]	RI lit.	Dry leaf oil[2]	Fresh leaf oil[2]
eucalyptol	1032	1026	9.99	7.68
γ-terpinene	1059	1054	0.45	-
linalool	**1100**	**1095**	**29.60**	**32.26**
terpin-4-ol	11880	1174	5.01	4.81
methyl chavicol	**1204**	**1195**	**36.81**	**41.62**
isobornyl acetate	1282	1283	0.89	-
methyl eugenol	1397	1403	1.10	-
E-caryophyllene	1421	1418	0.92	-
α-humulene	1454	1452	1.91	2.10
bicyclogermacrene	1493	1494	2.05	-
germacrene A	1497	1503	-	3.68
β-guaiene	1498	1504	1.16	-
γ-cadinene	1510	1513	0.94	1.74
tau-cadinol	1643	1638	2.76	-
	Total analyzed (%)		93.59	93.89

[1]RI: Retention Index: determined with reference to homologous series of n-alkanes in column VF-5ms. [2] Percentages were calculated by area normalization method. - not detected, Ri lit. Retention Index literature (Adams, 2007)

energy source and thus can cause the conversion of some substances into their isomers or favor the formation of oxygenated derivatives.

Vieira & Simon (2000), studying the essential oils of fourteen medicinal plants which were collected in Brazil and cultivated in the United States and distributed among the species *O. americanum*, *O. basilicum*, *O. campechianum*, *O. gratissimum* and *O. selloi*, observed variations in the chemical composition of the oils of one same species collected from different areas of Brazil, suggesting the existence of chemotypes. *O. basilicum* can be classified into four major essential oil chemotypes: methyl chavicol, linalool, methyleugenol and methyl cinnamate (Klimánková et. al, 2008). The chromatographic profile of essential oils of *Ocimum sp* cultivated in Bahia shows proximity to the essential oil of *O. basilicum* species; therefore, the relationship among different forms of *O. basilicum* can be considered reticulate, whereas the group taxonomy can be considered difficult (Graeyer, et al., 1996).

There are differences in the yield and chemical composition of essential oils obtained from fresh leaves and dry leaves of *Ocimum sp,* commonly used as medicinal plants by Brazilians. Although the drying process is important for the use of medicinal plants, there is a need for further investigations to establish the best drying conditions for this species.

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